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Lesson Topic: Division with whole numbers (Divide & Conquer)	Grade Level: 3

### Curriculum Standards (3 pts.)

#### TN Content Standards:

3.OA.A.2 Interpret the dividend, divisor, and quotient in whole number division equations (e.g.,  $28 \div 7$  can be interpreted as 28 objects divided into 7 equal groups with 4 objects in each group or 28 objects divided so there are 7 objects in the 4 equal groups.

#### Math Practice Standards:

- MP1: Make sense of problems and persevere in solving them.  
 MP2: Reason abstractly and qualitatively.  
 MP3: Construct viable arguments and critique the reasoning of others.  
 MP4: Model with mathematics.  
 MP6: Attend to precision.  
 MP7: Look for and make use of structure.

#### Literacy Skills for Mathematical Proficiency:

2. Understand and use correct math vocabulary
3. Discuss and articulate mathematical ideas

### Central Focus (5 pts.)

Represent and solve problems involving multiplication and division:

This lesson focuses on the conceptual understanding of equations used to model problem situations associated with multiplication and division. The relationships among the operations and their properties promote procedural fluency. Mathematical reasoning and number models are used to manipulate practical applications and to solve problems.

### Lesson Objectives (10 pts.)

1. TLW model the measurement (repeated subtraction) concept of division using counters and cups (or drawings).
2. TLW formulate equations to demonstrate the connection between the measurement concept of division to multiplication and addition.
3. TLW represent equations demonstrating the measurement concept of division by writing contextual story problems.
4. TLW create examples to demonstrate their understanding of content/academic vocabulary.

### Language Demands

Language Function (3 pts.): Represent

#### Learning Tasks:

- The teacher and students will work together in the introductory activity to demonstrate how to use the measurement model for division to represent the mathematics with drawings and equations.
- The teacher and students will work together in the introductory activity to create story problems to represent a situation in which someone might have 13 things and wants to find out how many sets of 3.

Content Vocabulary / Symbols (3 pts.):

Word	Definition
commutative property	property states that numbers can be added or multiplied in any order
dividend	an amount being divided

divisor	a number that divides into the dividend (also know as factor)
equation	a number sentence stating that the expressions on either side of the equal sign are in fact equal
inverse	an operation that reverses the effect of another operation
model	a mathematical representation for real world or mathematical objects, properties, actions, or relationships
partitioning	separating into equal parts
quotient	the answer to a division problem
remainder	an amount left over after dividing a number

#### Instructional Support:

- Physical supports used to encourage content and academic language use during the lesson include: content/academic vocabulary anchor chart, student math notebooks, counters & cups, and dry erase board & markers.
- Students will have opportunities to model problems, discuss, and write about their work using the dry erase board & markers as well as their math notebooks.
- The teacher and students will work together in the introductory activity to demonstrate how to use the measurement model for division to represent the mathematics with drawings and equations.
- The teacher and students will work together in the introductory activity to create story problems to represent a situation in which someone might have 13 things and wants to find out how many sets of 3.
- The teacher will be modeling the correct use of each of the Content/Academic Vocabulary and the language function throughout the lesson while also monitoring for correct student use of the words in their discussions.
- During student discussions, the teacher will ask probing questions to elicit the use of the Content/Academic Vocabulary as well as the language function, model.
- Students who are struggling to learn the new vocabulary will be paired with students who can offer support and encouragement during the discussions.

#### Academic Vocabulary (Address Syntax and/or Discourse) (3 pts.):

##### Syntax:

- Students will have opportunities to discover the relationship between multiplication and addition as well as multiplication and division using the equations created during the lesson (Example:  $3 + 3 + 3 + 3 + 1 = 13$ ;  $4 \times 3 + 1 = 13$ ;  $13 \div 3 = 4$  with 1 left over). This will aid in their understanding of how to represent multiplication and division contextual problems in numerical form.
- Students will utilize the vocabulary chart in the student math notebooks to connect the content/academic vocabulary to definitions and examples. This will aid in their understanding and correct use of the vocabulary.

##### Discourse:

Students will have multiple opportunities to explain their mathematical reasoning to each other and to the teacher during the lesson particularly about using mathematical models to represent division problems.

#### Assessment/Evaluation

##### Formative: (10 pts.)

- Observe for evidence that students see the connection between the action of finding how many equal sets in a given quantity. (Correct modeling with counters and cups)
- Observe for evidence that students see the manner in which a multiplication equation and a division equation are connected. (Correct equations on dry erase boards)

- Listen that story problems indicate the action of measuring equal sets of 4 rather than dividing the quantity into four sets in a process of sharing or partitioning. If students make this error, simply have them discuss whether or not the story fits well with the action. Do not indicate that the story is incorrect. It is also possible that students will create multiplication stories with 31 being the unknown amount. Here, ask students which equation best represents the problem.

Summative: (5 pts.)

Assessment Tool: Student Math Notebook (See Rubric Attached)

[Objective 4: TLW create examples to demonstrate their understanding of content/academic vocabulary.] Students should work individually to complete the final column in their content/academic vocabulary glue-in in their math notebooks. They should add a new example for each word in the table. Mastery =  $\frac{3}{4}$

[Objectives 1-3: TLW model the measurement (repeated subtraction) concept of division using counters and cups (or drawings). TLW formulate equations to demonstrate the connection between the measurement concept of division to multiplication and addition. TLW represent equations demonstrating the measurement concept of division by writing contextual story problems.] Students should model the following situation with a drawing and equations: 7 items in groups of 2. Students should write a story problem to represent an equation demonstrating the measurement concept of division. Mastery =  $\frac{3}{4}$

(All objectives will also be assessed later at the end of the unit with situations similar to those in this lesson.)

## Instruction

Set: (10 pts.)

(Before the lesson begins) As a bell ringer activity, students will paste the content/academic vocabulary table in their math notebooks. They will be expected to read the words, definitions, and examples with a partner. (This occurs at the beginning of the day while the teacher takes attendance and collects notes, homework, money, etc.)

➤ Begin with a simpler version of the task (5–10 minutes):

- Draw 13 counters (dots) on the board. Ask, “How many sets of 3 can we make if we have 13?”
- How many will be left over?” Most students should be able to answer this question mentally.
  - use wait time
  - turn and talk with partners
  - listen as students are sharing
  - choose students to share that are able to demonstrate how to verify the answer of four sets of 3 and 1 left

(Note: Depending on student readiness, you may want to precede the first step using a number such as 12 so that there are no remainders. Do not wait too long before remainders are addressed.)

- Ask, “What equation could we write for what we have on the board?” Use wait time before accepting students’ ideas and writing them on the board.

Correct ideas include:

$$\Rightarrow 3 + 3 + 3 + 3 + 1 = 13$$

$$\Rightarrow 4 \times 3 + 1 = 13 \text{ (} 3 \times 4 + 1 \text{ technically represents three sets of 4 and 1 more.)}$$

$$\Rightarrow 13 \div 3 = 4 \text{ with 1 left over}$$

- Discuss the connection between these equations and the operations:
  - pose the question to the group
  - use wait time
  - turn and talk with partners
  - listen as students are sharing
  - choose students to share that noticed the inverse relationships between addition/subtraction and multiplication/division.
- Explain that what the students just worked on was a mathematical representation called modeling. They modeled the situation with 13 items in sets of 4 both with dots and an equation.
- Allow time for discussion from students about their experiences with modeling.
- Say, “Think of a situation in which someone might have 13 things and wants to find out how many sets of 3. Make up a story problem about your situation.”

- After some wait time, have 2–3 students share their story problems.

#### Instructional Procedures: (12 pts.)

- Present the focus task to the class (< 5 minutes):
  - Distribute small paper cups or portion cups and counters to students. Pose the two problems:
    - ◆ Use 31 counters to see how many sets of 4 you can make.
    - ◆ Use 27 counters to find out how many sets of 6 you can make.
  - Ask students for ideas of how they might use the cups to help them solve the problems.
- Provide clear expectations (< 5 minutes):
  - Instruct students to work with pre-assigned partners.
  - Write the directions on the board:
    1. Represent how many sets of 4 you can make using 31 counters using a model.
    2. Write three equations: one addition, one multiplication, and one division. (on partner 1's dry erase board)
    3. Write a story problem to go with the division equation. (on partner 1's dry erase board)
  - Repeat steps 1, 2, and 3 using 27 counters to make sets of 6. (on partner 2's dry erase board)
- Initially (5 minutes):
  - Observe that each student understands the task and is in the process of attempting to solve the first situation.
  - If you find that some students, particularly those with disabilities, are struggling, you may need to start them by supporting them in the placement of 4 counters in the first cup. Then they should be able to use that model to continue.
  - If some students struggle with writing, support them by allowing drawings instead.
- Ongoing (15 minutes):
  - Ask students to explain and show on their dry erase boards why their equations go with what they modeled with the counters.
  - Do not correct incorrect equations or story problems. You only want to be sure students are attempting to connect the activity with the symbolism and the stories.
  - Make anecdotal notes as students are working. Monitor their success with each objective, while also noting students to present their work during the closure.
  - Challenge early finishers to see if they can do the same thing for 125 things in sets of 20. However, they will have to figure it out without using counters.

#### Closure: (10 pts.)

- Bring the class together to share and discuss the task (15–20 minutes):
 

(Throughout discussion, look for opportunities to encourage students to use the content/academic vocabulary correctly.)

  - Have students (chosen during student work time) to show how they know how many sets of 4 can be made with 31 counters.
    - A picture may be drawn on the board or use counters on the document camera with a projector.
  - Have students (chosen during student work time) share their equations.
    - Students should explain how their equations match what was done with the counters. If students disagree, have them respectfully explain their reasoning. Students should be comfortable with their ideas about the multiplication and addition equations. Because this is an introductory lesson on division, you should correct any misunderstandings about the division equation and what it means.
  - Have students (chosen during student work time) to share their story problems.
    - Students should explain how the story situation matches the action of finding how many sets of 4 are in 31. For example: "There were 31 apples in the basket. If each apple tart requires 4 apples, how many tarts can be made?"
  - Repeat with the  $27 \div 6$  situation.
- Individual Assessment (10–15 minutes):
  - Students should work individually to complete the final column in their content/academic vocabulary glue-in in their math notebooks. They should add a new example for each word in the table.

- Students should model the following situation with a drawing and equations to represent: 7 items in groups of 2.
- Students should write a story problem to represent an equation demonstrating the measurement concept of division.
- As students finish, they will have the choice of continuing practice on this topic through the following web-based resources:
  - <http://www.ixl.com/math/grade-3/division-word-problems-facts-to-10>
  - <http://www.ixl.com/math/grade-3/complete-the-division-table>
  - <http://illuminations.nctm.org/Activity.aspx?id=4213>
  - <http://www.oswego.org/ocsd-web/games/SumSense/summulti.html>

Questions and/or activities for higher order thinking: (5 pts.)

- How many sets of 6 can be made with 27 counters?
- How do you know that your equation matches this situation?
- Explain and show on your dry erase board why your equation goes with the model you created with the counters.
- How do you know that your equation matches this situation?
- How does your equation relate to multiplication?
- Create a new example for each of the content/academic vocabulary words in your notebook.

Adaptations to Meet Individual Needs: (5 pts.)

Preselected partners will be chosen based on student ability as determined by benchmark testing and teacher anecdotal records. Most students will be partnered with another student from an adjacent ability group as recommended by Kagan (2009). They will also be based on student personalities to allow for beneficial social interaction with minimal behavioral issues.

- High-Level Learners: As the teacher is monitoring both partner and individual work, questions will be tailored to a higher-level of Bloom's taxonomy and may include higher values of numbers for these learners as needed. Challenge early finishers to see if they can create equations and write a story problem for 125 things in sets of 20 without using counters.
- On-Level Learners: This lesson plan is structured for on-level learners as written.
- Struggling Learners: As the teacher is monitoring both partner and individual work, questions will be tailored to an appropriate level of Bloom's taxonomy and may include lower values of numbers for these learners as needed while still providing challenge at their Zone of Proximal Development (ZPD). If some students struggle with writing, support them by allowing drawings instead of written story problems. Initially during the main activity, if some students are struggling, you may need to start them by supporting them in the placement of the correct amount counters in the first cup. Then they should be able to use that model to continue. Students who are struggling to learn the new vocabulary will be paired with students who can offer support and encouragement during the discussions.
- English Language Learners: Provide additional support as needed for vocabulary through the use of a peer tutor and/or picture cues. Students who are struggling to learn the new vocabulary will be paired with students who can offer support and encouragement during the discussions. If some students struggle with writing, support them by allowing drawings instead of written story problems. Initially during the main activity, if some students are struggling, you may need to start them by supporting them in the placement of the correct amount counters in the first cup. Then they should be able to use that model to continue.

Management/Safety Issues: (3 pts.)

- Students should follow all previously established classroom rules.
- Students will be responsible for returning all manipulatives to the bags that they came in after they are finished using them.
- Anytime the teacher needs student attention, the teacher will say "Divide" to which the students will reply "And Conquer".
- When working with partners, students will be reminded and monitored for staying on task.

Material/Resources: (2 pts.)

<p>Teacher:</p> <p>Content/academic vocabulary anchor chart  Dry erase board  Dry erase marker  35 counters  Small paper cups or portion cups  Document camera  Projector</p>	<p>Students:</p> <p>Math notebooks  Content/academic vocabulary table glue-in (see attached)  35 counters  Small paper cups or portion cups that will hold at least 6 counters  Dry erase board  Dry erase marker  Eraser or cloth for dry erase board</p>
<p>References: (2 pts.)</p> <ul style="list-style-type: none"> <li>Georgia Department of Education. 2014. Common Core Georgia Performance Standards Framework, Third Grade Mathematics: Unit 2. <a href="https://www.georgiastandards.org/Common-Core/Common%20Core%20Frameworks/CCGPS_Math_3_Unit2Framework.pdf">https://www.georgiastandards.org/Common-Core/Common%20Core%20Frameworks/CCGPS_Math_3_Unit2Framework.pdf</a></li> <li>Hands-On Standards, Deluxe Edition Grade 1-2, Teacher Resource Guide with Assessments Book <a href="http://www.hand2mind.com/brands/handsonstandards/hands-onstandardsdeluxeedition">http://www.hand2mind.com/brands/handsonstandards/hands-onstandardsdeluxeedition</a></li> <li>Kagan, S. &amp; Kagan, M. 2009. Kagan cooperative learning. <i>Kagan Publishing</i>.</li> <li>Kansas Association of Mathematics Teachers. 2014. 3rd Grade Common Core State Standards Flipbook <a href="http://www.katm.org/flipbooks/3%20FlipBook%20Final%20CCSS%202014.pdf">http://www.katm.org/flipbooks/3%20FlipBook%20Final%20CCSS%202014.pdf</a></li> <li>Public Schools of North Carolina. Lessons for Learning for the Common Core State Standards for Math: Grade 3 <a href="http://maccss.ncdpi.wikispaces.net/file/view/CCSSMathTasks-Grade3.pdf">http://maccss.ncdpi.wikispaces.net/file/view/CCSSMathTasks-Grade3.pdf</a></li> <li>Van de Walle, Karp, &amp; Bay-Williams. 2016. Expanded lesson: Divide and conquer. <i>Pearson Education</i>.</li> <li>Vygotsky, L.S. (1978). <i>Mind in society. The development of higher psychological processes</i>. Cambridge, MA: Harvard University Press.</li> </ul>	

<p>Rationale/Theoretical Reasoning</p> <p>Misconceptions (3 pts.):</p> <ul style="list-style-type: none"> <li>Students may have difficulty seeing multiplication and division as inverse operations. In order to develop an understanding of this relationship, students need to have ample opportunities to explore these two operations simultaneously.</li> <li>The three ways of looking at division (separating into equal groups, repeated subtraction, and inverse of multiplication) are closely related and may be difficult for students to verbalize initially as they make connections between concrete models and their corresponding number sentences. Therefore, students need multiple experiences using a given number of cubes to model repeated subtraction, form equal groups, and explain how these two activities are alike and different. They also need to understand the inverse relationship of multiplication and division. Help students make connections to the language of mathematics and between visual and symbolic representations.</li> </ul> <p>(<a href="https://www.georgiastandards.org/Common-Core/Common%20Core%20Frameworks/CCGPS_Math_3_Unit2Framework.pdf">https://www.georgiastandards.org/Common-Core/Common%20Core%20Frameworks/CCGPS_Math_3_Unit2Framework.pdf</a>)</p>
<p>Theory (3 pts.):</p> <ul style="list-style-type: none"> <li>The purpose of teaching through a concrete-to-representational-to-abstract sequence of instruction is to ensure students truly have a thorough understanding of the math concepts/skills they are learning. When students who have math learning problems are allowed to first develop a concrete understanding of the math concept/skill, then they are much more likely to perform that math skill and truly understand math concepts at the abstract level. (Hands-On Standards, Deluxe Edition Grade 1-2, Teacher Resource Guide with Assessments Book <a href="http://www.hand2mind.com/brands/handsonstandards/hands-onstandardsdeluxeedition">http://www.hand2mind.com/brands/handsonstandards/hands-onstandardsdeluxeedition</a>)</li> <li>Students are provided an opportunity to socially construct knowledge while working with their peers. They also have</li> </ul>

the opportunity to work in their zone of proximal development as determined by benchmark testing and grade level standards. (Van de Walle, Karp, & Bay-Williams, 2016)

- Choosing partners with adjacent ability levels provides for a heterogeneous grouping while avoiding frustration on the part of either student. This is opposed to a partnership with significant differences in ability levels often resulting in conflict.

(Kagan, S. & Kagan, M. 2009. Kagan cooperative learning. Kagan Publishing.)

Rationale (3 pts.):

- This standard focuses on two distinct models of division: partition models and measurement (repeated subtraction) models. Partition models focus on the question, "How many in each group?" A context for partition models would be: There are 12 cookies on the counter. If you are sharing the cookies equally among three bags, how many cookies will go in each bag? Measurement (repeated subtraction) models focus on the question, "How many groups can you make?" A context or measurement models would be: There are 12 cookies on the counter. If you put 3 cookies in each bag, how many bags will you fill? Students need to recognize the operation of division in two different types of situations. One situation requires determining how many groups and the other situation requires sharing (determining how many in each group).
- To develop this understanding, students interpret a problem situation requiring division using pictures, objects, words, numbers, and equations. Given a division expression (e.g.,  $24 \div 6$ ) students interpret the expression in contexts that require both interpretations of division.

(Kansas Association of Mathematics Teachers. 2014. 3rd Grade Common Core State Standards Flipbook

<http://www.katm.org/flipbooks/3%20FlipBook%20Final%20CCSS%202014.pdf>)

(Van de Walle, Karp, & Bay-Williams, 2016)